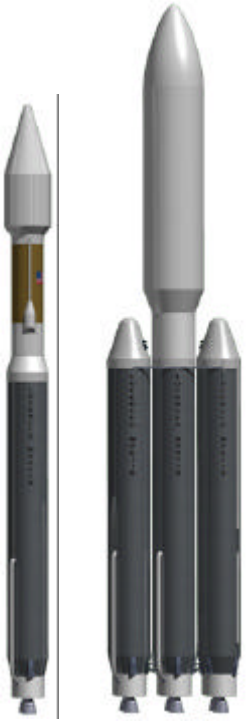
Evolved Expendable Launch Vehicle
Program Office

Program Status Briefing

Delta IV

Col Robert K. Saxer
EELV System Program Director

29 Jun 00



Atlas V

Outline

- **Program Overview**
- **Program Status**
  - Delta IV
  - Atlas V
- **Restructure Summary**

Program Overview

Essential Elements of the EELV Mission

- **Partner with industry**
- **Develop a national launch capability**
- **Satisfy Government and Commercial payload requirements**
- **Reduce the cost of space launch by at least 25%**

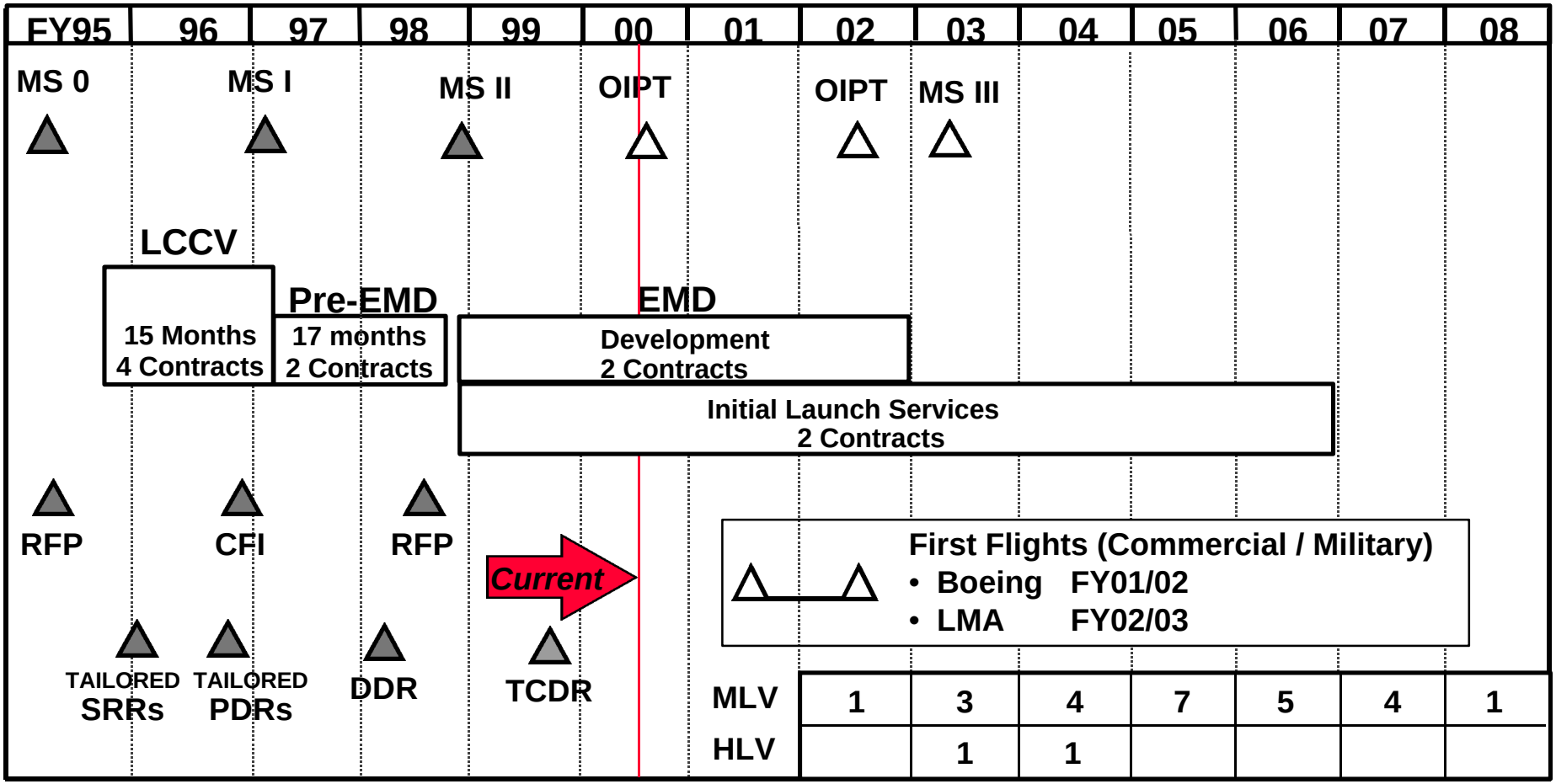
Program Overview

ORD KPP Requirements

- **Performance:**
  - Mass to Orbit
- **Reliability:**
  - Vehicle Design Reliability
- **Standardization**
  - Launch Pads
  - Payload Interfaces

Program Overview

Program Schedule



Pre-EMD - Pre-Engineering & Manufacturing Development
TCDR - Tailored Critical Design Review
RFP - Request for Proposal
CFI - Call For Improvements
MS - Milestone

LCCV - Low Cost Concept Validation
SRR - Systems Requirements Review
PDR - Preliminary Design Review
DDR - Down-select Design Review

Program Overview

Initial Launch Services Split - As of Feb 00

	FY02	FY03	FY04	FY05	FY06	FY07	FY08
Boeing $1.38B 19 Missions	DSCS	DSP A/B-1 DSCS	A/B-4 Mission C WGF	WGF **GPS IIF** STP(TSX) **SBR/MTI**	SBIRS-G **GPS IIF** **GPS IIF**		
LMA $0.65B 9 Missions		DMSP	A/B-2 SBIRS-G	DMSP WGF SBIRS-G	**GPS IIF** **GPS IIF**	**GPS IIF**	

DSCS - Defense Satellite Communication System
GPS - Global Positioning System
DSP - Defense Support Program
WGF - Wideband Gap Filler
STP - Space Test Program
SBIRS - Space Based Infra Red Radar System
DMSP - Defense Meteorological Satellite Program
AEHF - Advanced Extremely High Frequency

FY03/04 SBR/MTI (2) - Space Based Radar / Moving Target Indicator missions dual manifested for FY05 launch
6 GPS HF Missions have moved to FY 09 / 10
Missions in RED reflect FY01 PB

Recent Program Activities

- **EELV family expanded to include Solids**
  - SEIS ROD approved - 24 May 00
- **SIS version 6 in final approval cycle**
  - Winner of 1999 Defense Standardization Award for SIS
- **Restructure nearing completion**
  - Final contractor settlements in place; Awaiting SECAF / OSD approval
- **Atlas IIIA / RD-180 successfully launched**
- **Mission Integration Proceeding on DSCS, DSP, DMSP, A/B-1, and Mission C**
- **DSCS Mission Ordered - 28 Jun 00**

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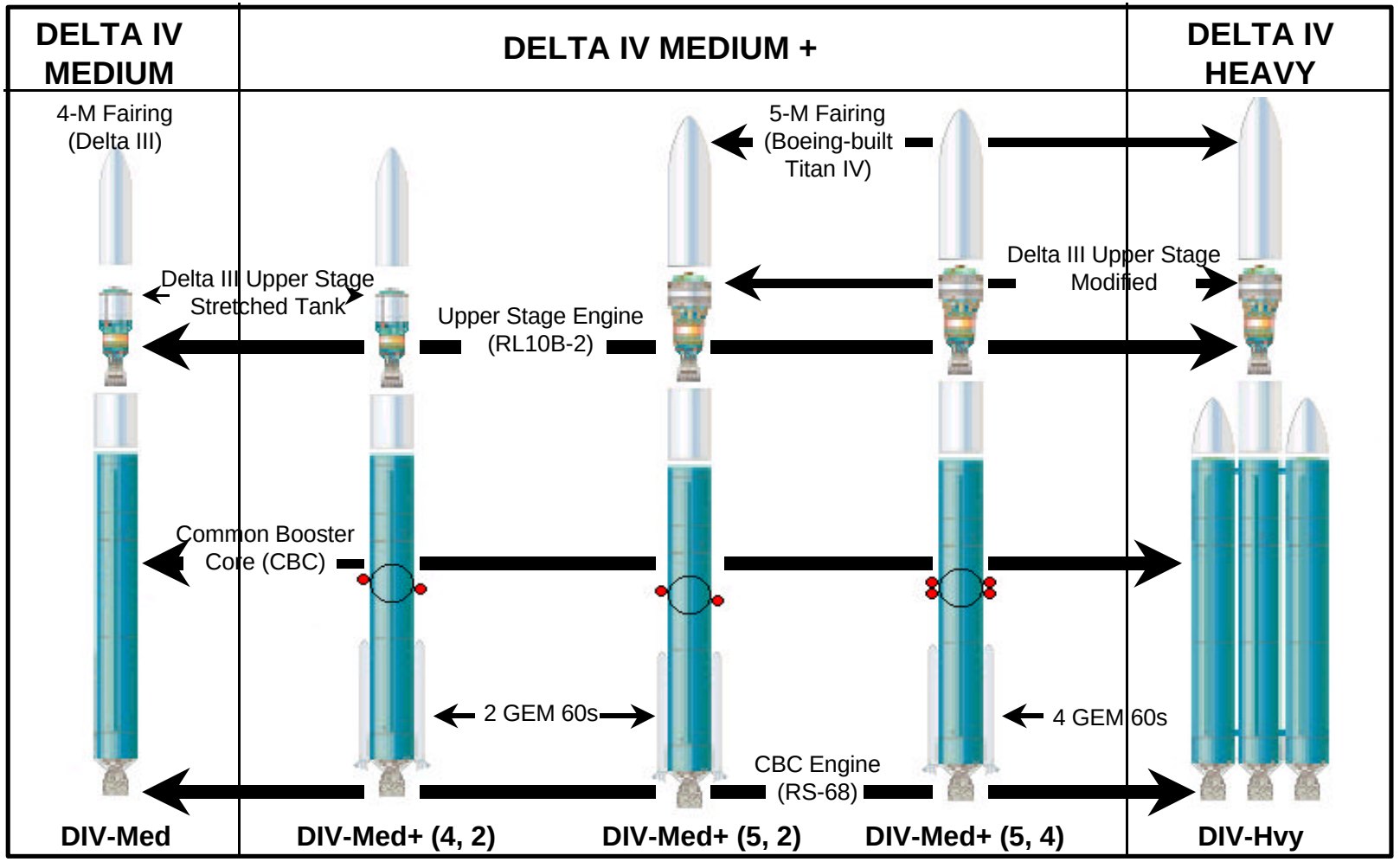
Delta IV
Launch Vehicle Family



Performance: GTO (lbs)	9,200	11,700	9,600	13,500	27,400

CBC Qualification Articles

Interstage

QT-48 Centerbody

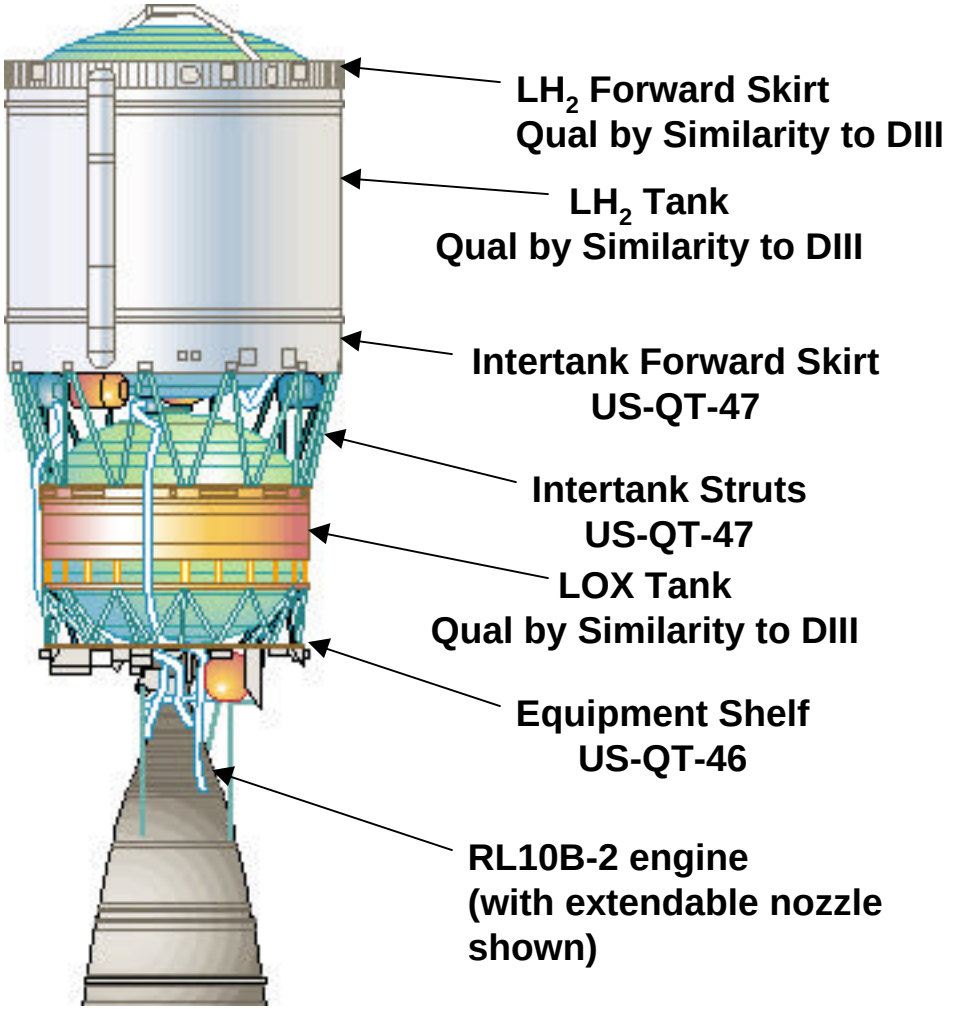
M+ LOX Tank

QT-49 Engine Section

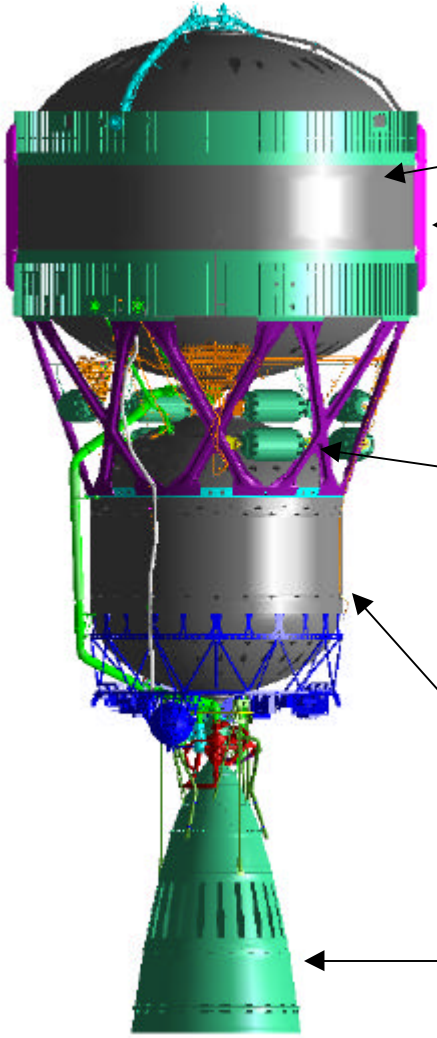
Thermal Shield

QT-47 LH2 Tank Test

Medium Upper Stage



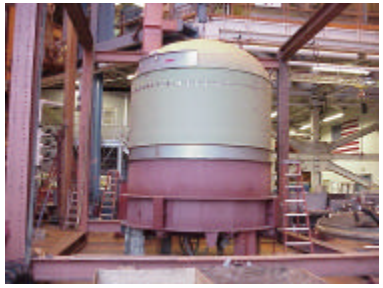
Heavy Upper Stage Qualification Articles



QT-44 Structural Loads
QT-39 Separation/Shock

QT-33 LH2 Tank

Intertank Strut



QT-32 LOX Tank

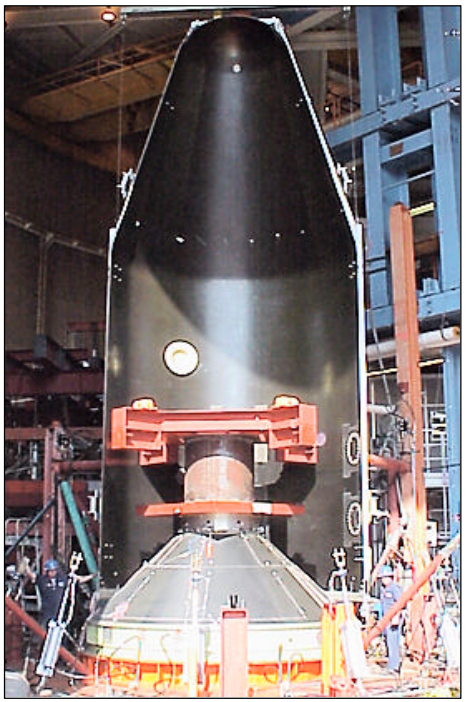
RL-10

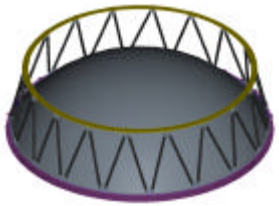
Payload Accommodations Qualification

5m PLF
QT-03

5M Payload Fairing

4m PLF
Qualified via D-III





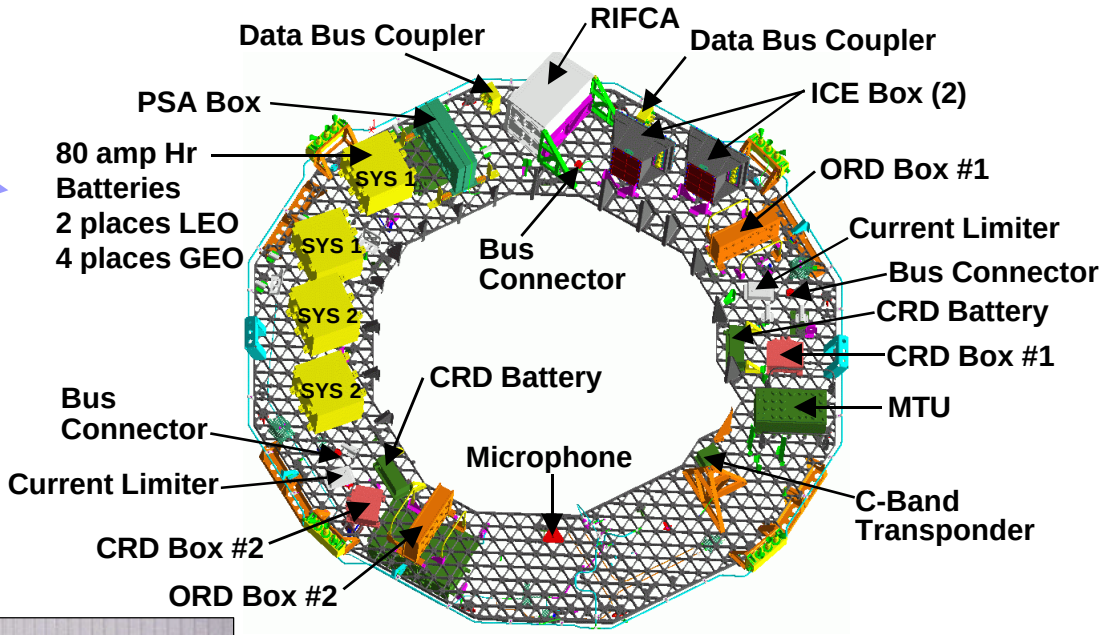
5m PAF
QT-03/12

4m PAF
QT-01

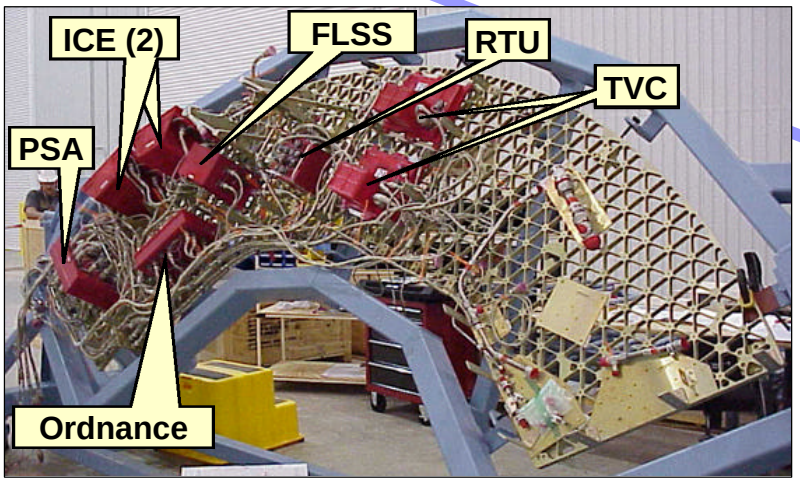
D-IV Heavy

D-IV Medium

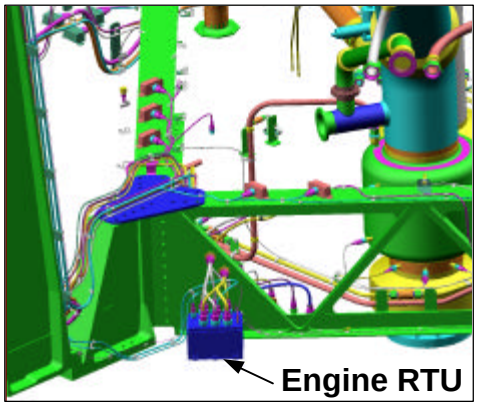
Avionics Qualification Articles



Upper Stage equipment shelf



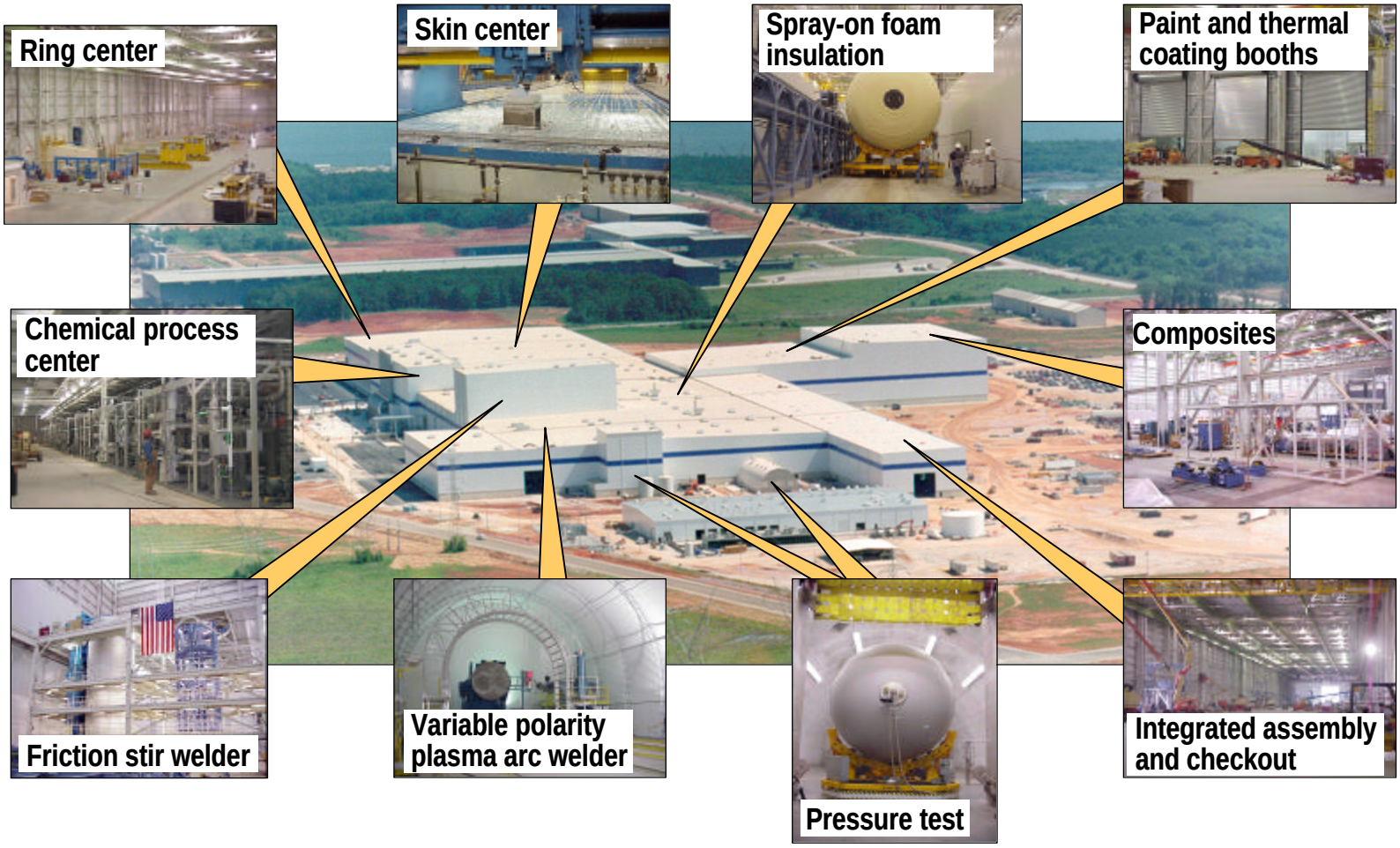
CBC centerbody equipment shelf



CBC engine section equipment pallet

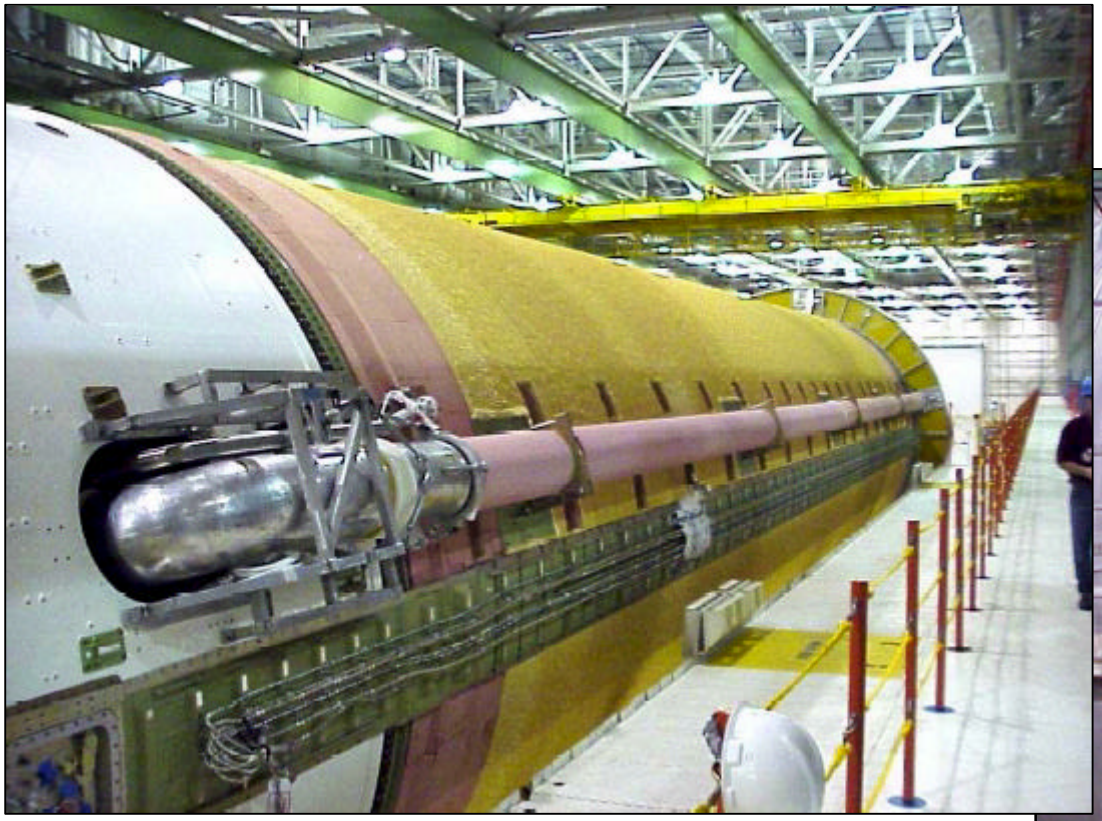
Delta IV

Decatur Operations Facility (Focused Factory)

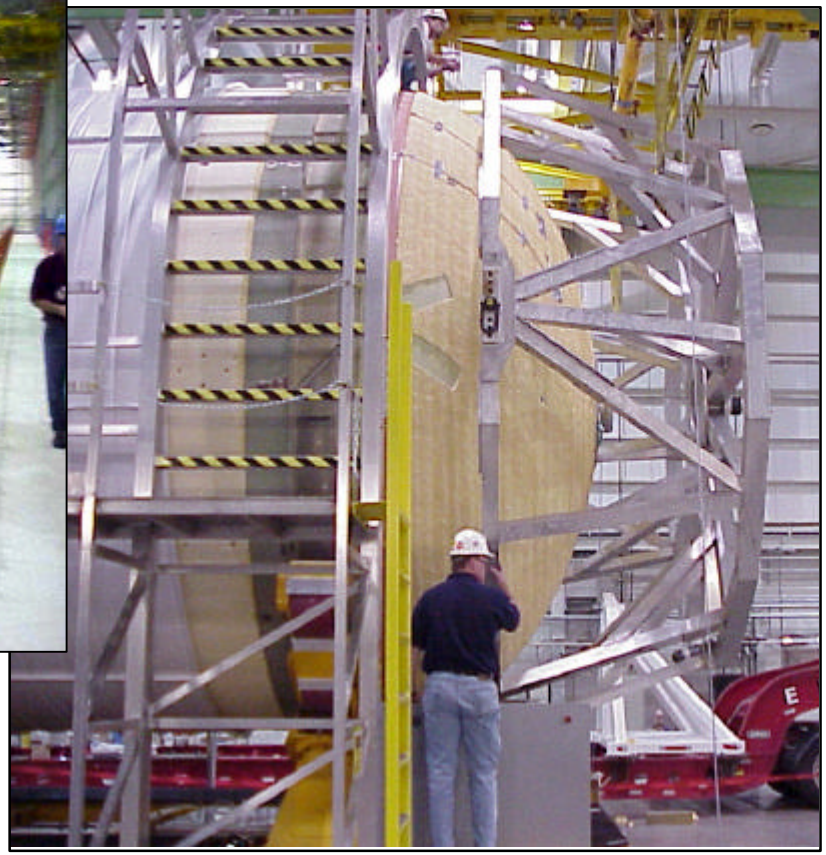


Delta IV

Decatur Operations Facility (Focused Factory)



CBC Liquid Oxygen Feedline
and Tunnel Installation



CBC Liquid Oxygen Tank
Shipped for Loads Testing

Key Manufacturing Facilities

Canoga Park
IOC 10/00 (RS-68)

Iuka
IOC 5/99

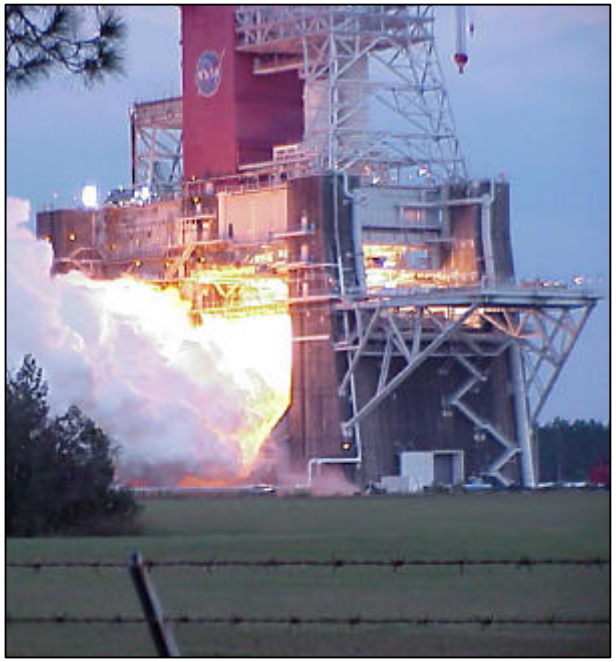
RS-68 Assy Facility
IOC 3/00

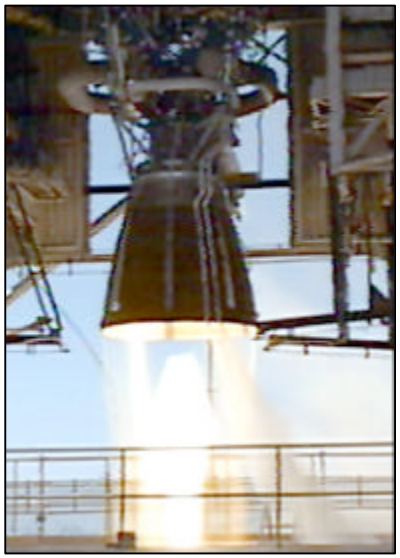
El Paso
IOC 7/99

Delta IV

RS-68 Engine

Stennis B-1A / B
2 Positions Operational



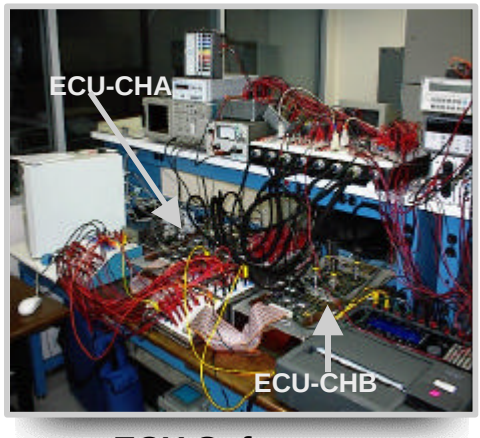


Edwards
AFRL 1-A

3000+ Total Secs

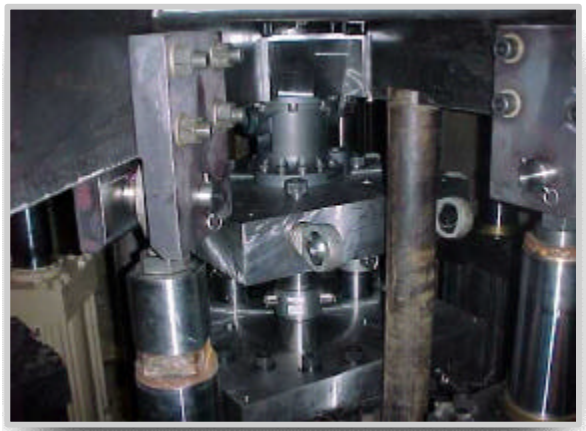
100% Power Demonstrated

RS-68 Component Qualification Testing

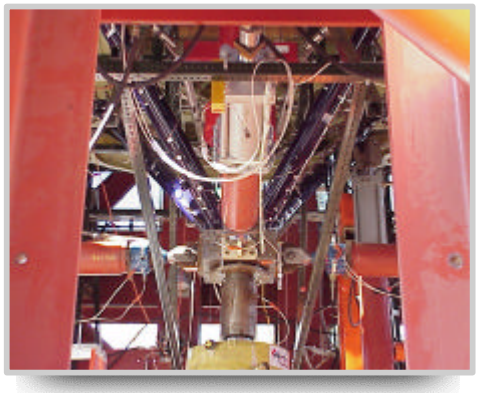


ECU Software
(complete)

Flex Line Bundle
(complete)

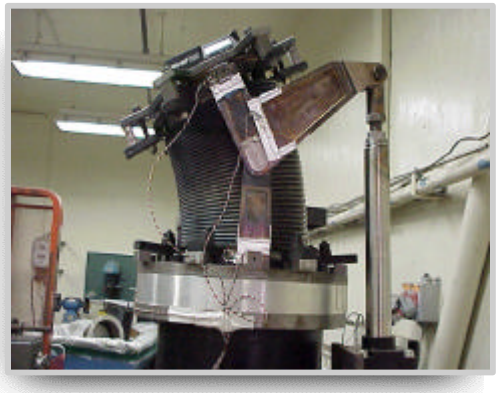


Gimbal Bearing
(complete)



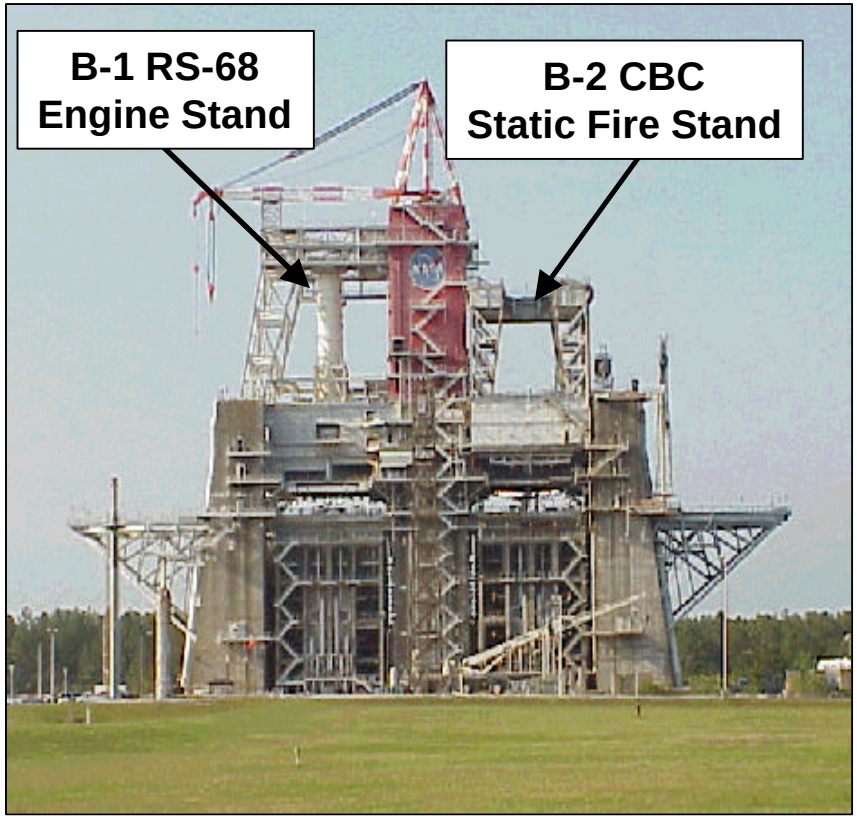
Thrust Frame
(complete)

Main Duct Flex Sections
(Life cycle tests complete)



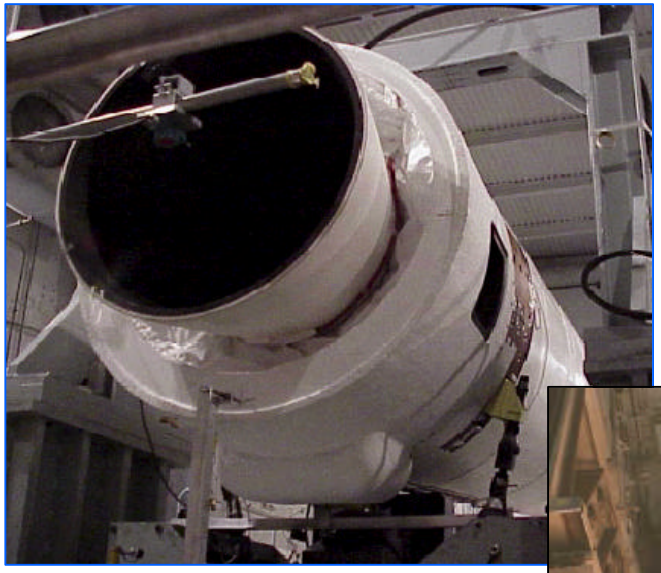
Roll Control Flex Joint
(complete)

CBC Hot Fire Qualification



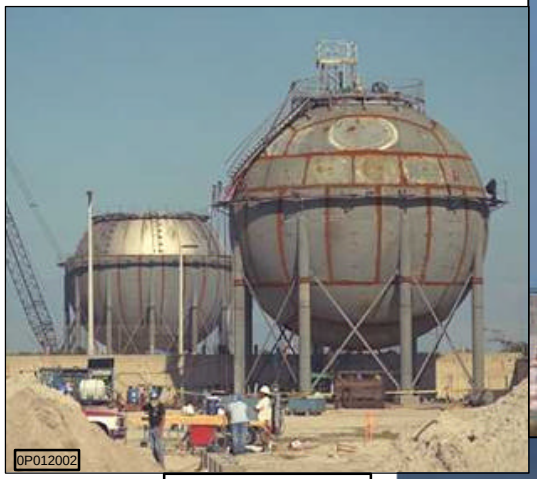
Static Fire Test Unit

GEM 60 Qualification Testing

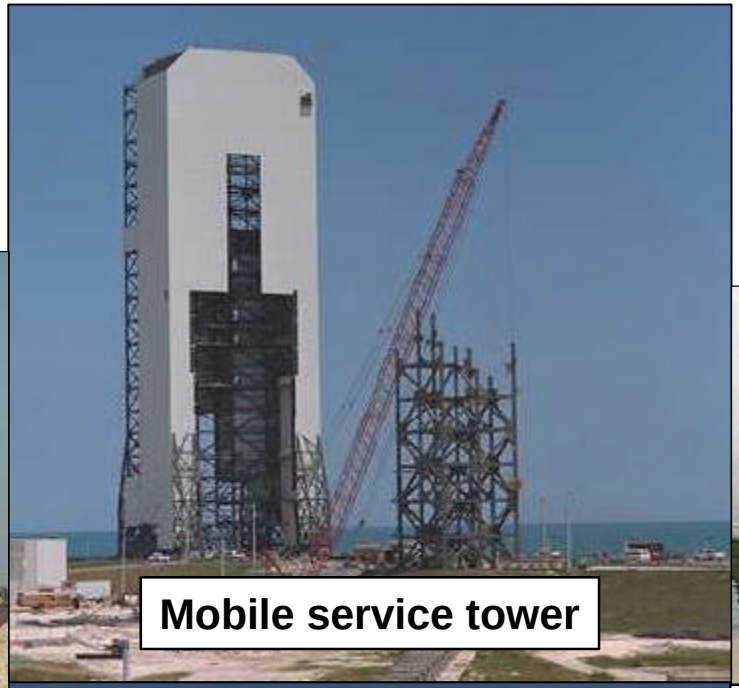


Delta IV

CCAS Construction

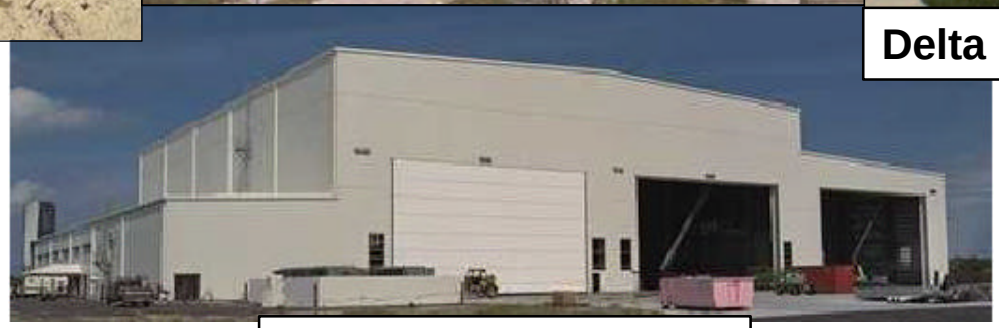


LH_2 tank



Mobile service tower

Delta Operations Center



Horizontal Integration Facility Construction

HIF Animal Control Activities

(10 Footer)

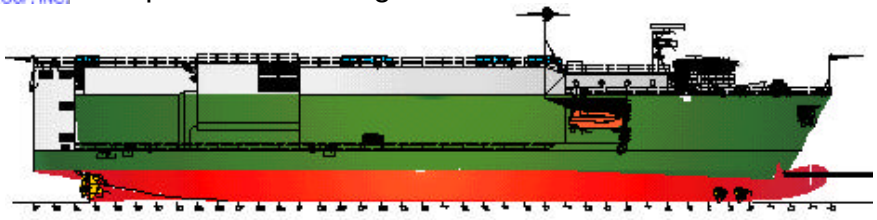
Delta IV

EELV Marine Transport Vessel

Owner/operator - Seattle, WA

Design architects - Seattle, WA

Ship builder -Pascagoula MS



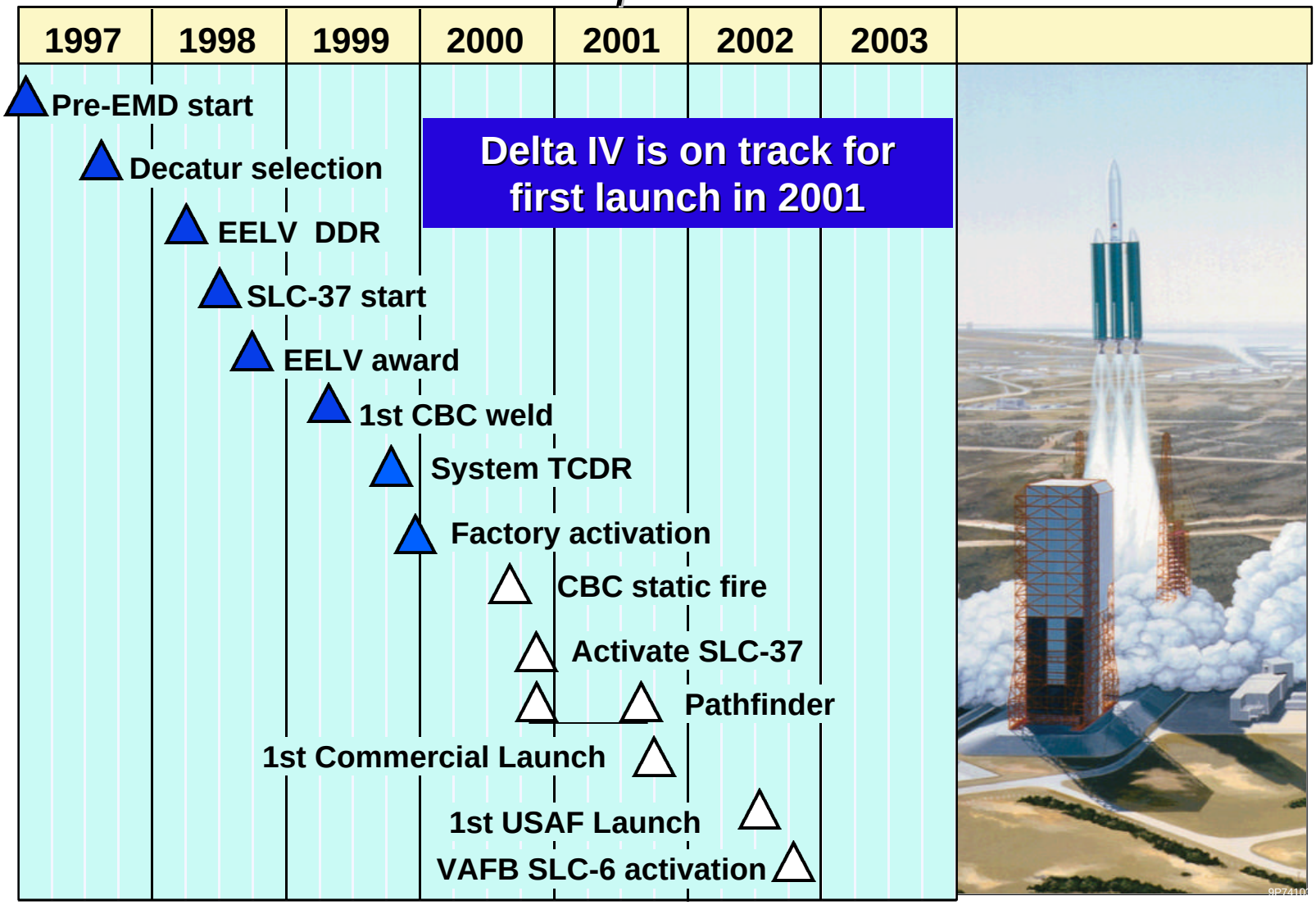
SLC - 6 / VAFB

IOC 6/02

SLC-6 Delta Operations Center

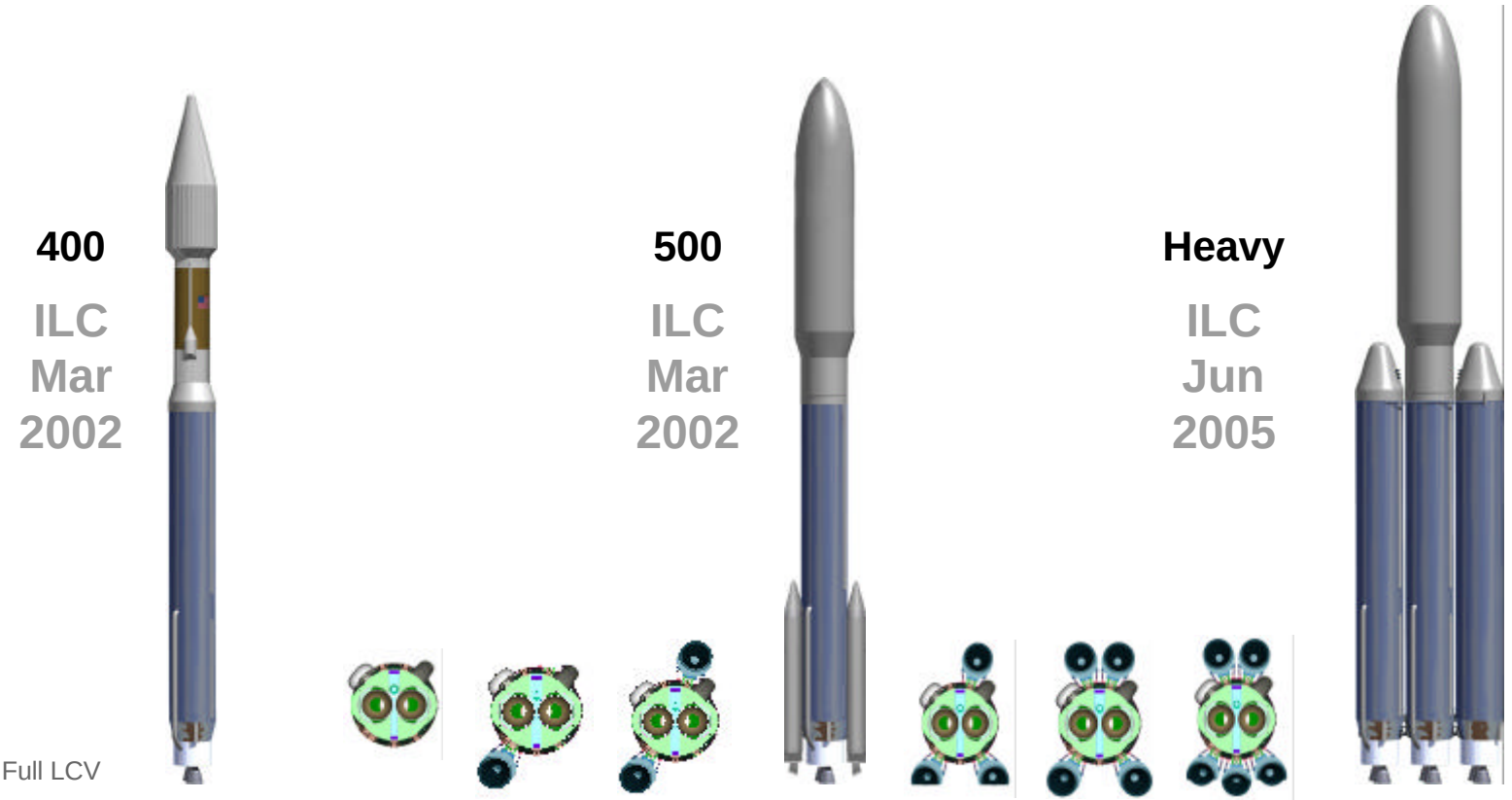
Delta IV

Development Schedule



Atlas V

System Capability



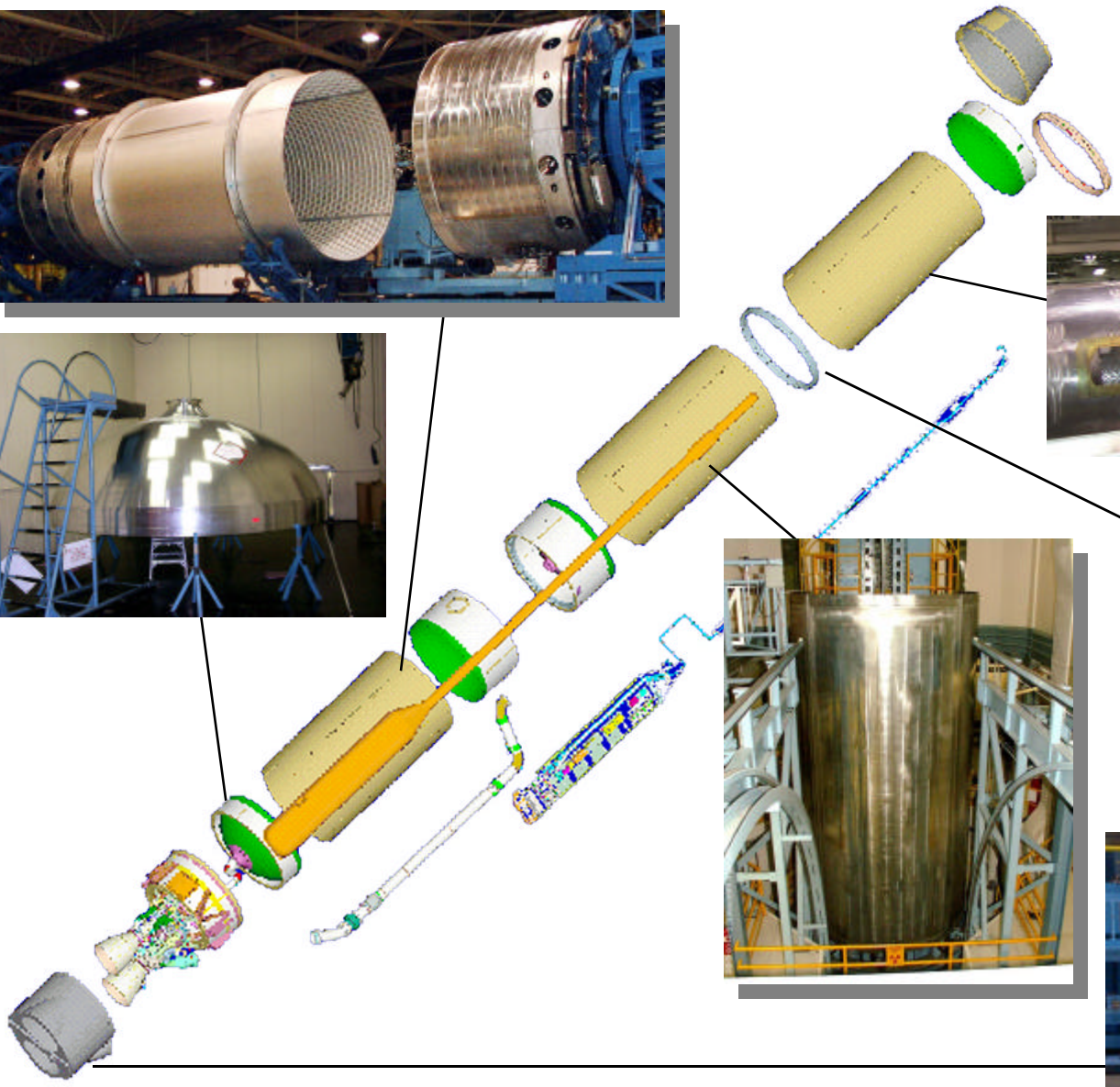
'000 lbs

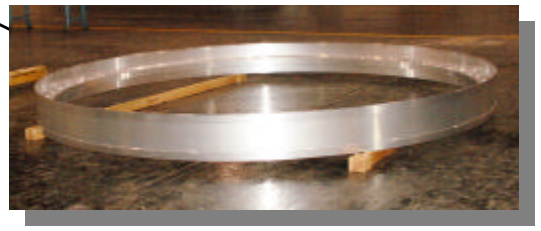
2.33 Sigma FPR, Full LCV

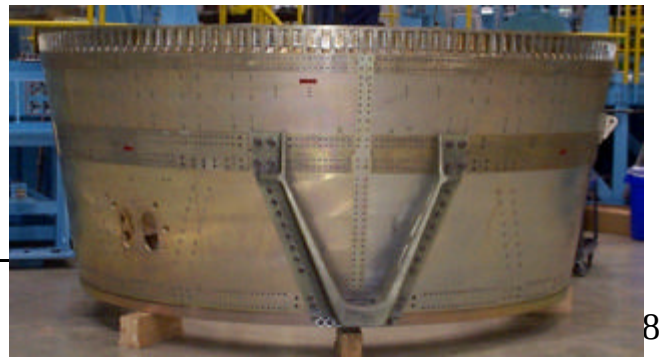
	400	500			Heavy			
GTO	11.0	9.0	10.8	13.2	15.2	16.7	18.0	29.0
GSO	–	3.3	3.9	4.9	6.6	7.5	8.2	14.0
LEO Polar[2]	20.0[1]	20.0	22.5	26.1	32.2	35.0	37.4	42.0[1]

1 - Additional Capability with Mission Unique Accommodations up to 23,700lb on 402, 53,000 on HLV
2 - DEC except HLV

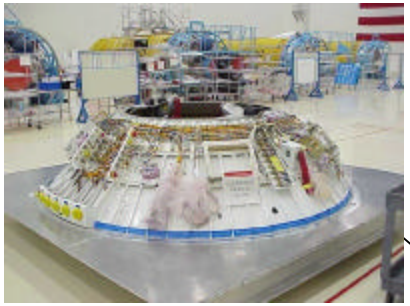
Atlas V CCB Qualification Articles



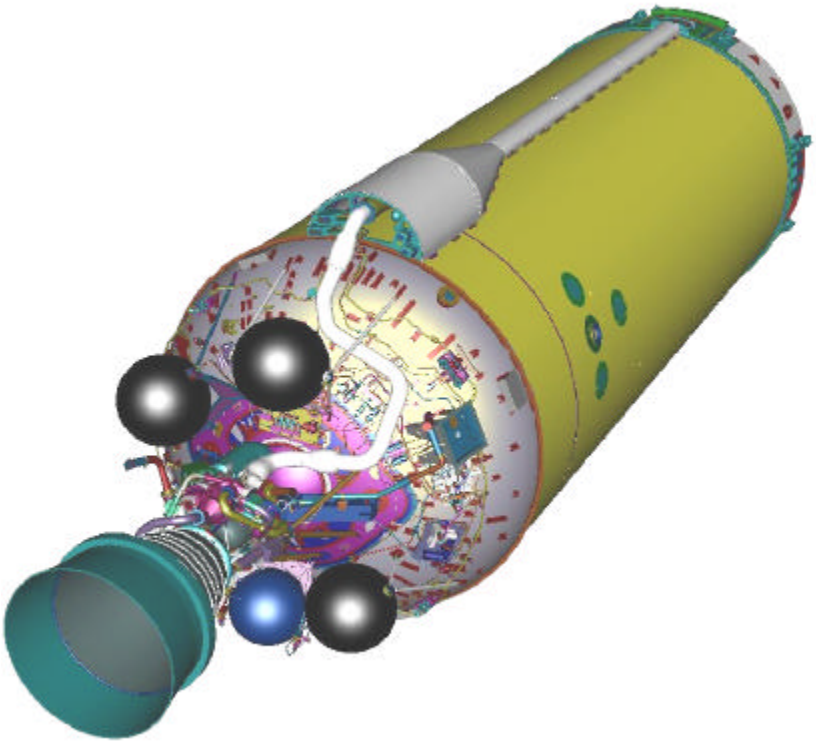




Centaur Upper Stage



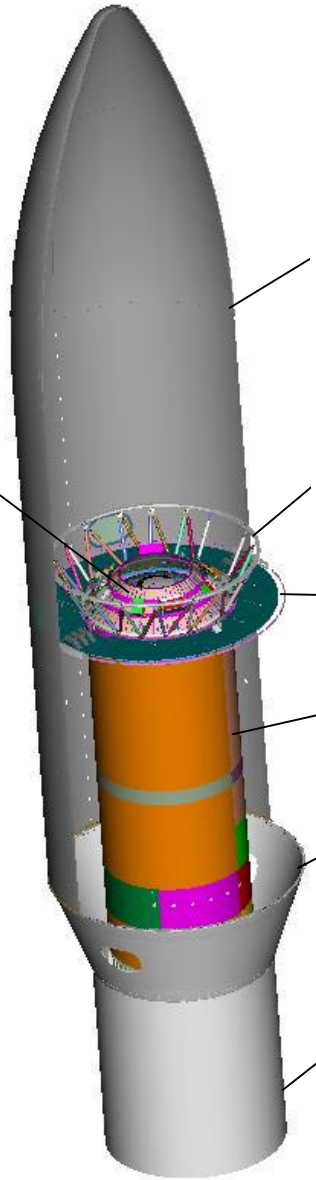
Forward Equipment Module



First Stretched Centaur

Fairings and Adapters

Fwd Conical Adapter



Proven design is basis for Contraves 5.4m Fairing

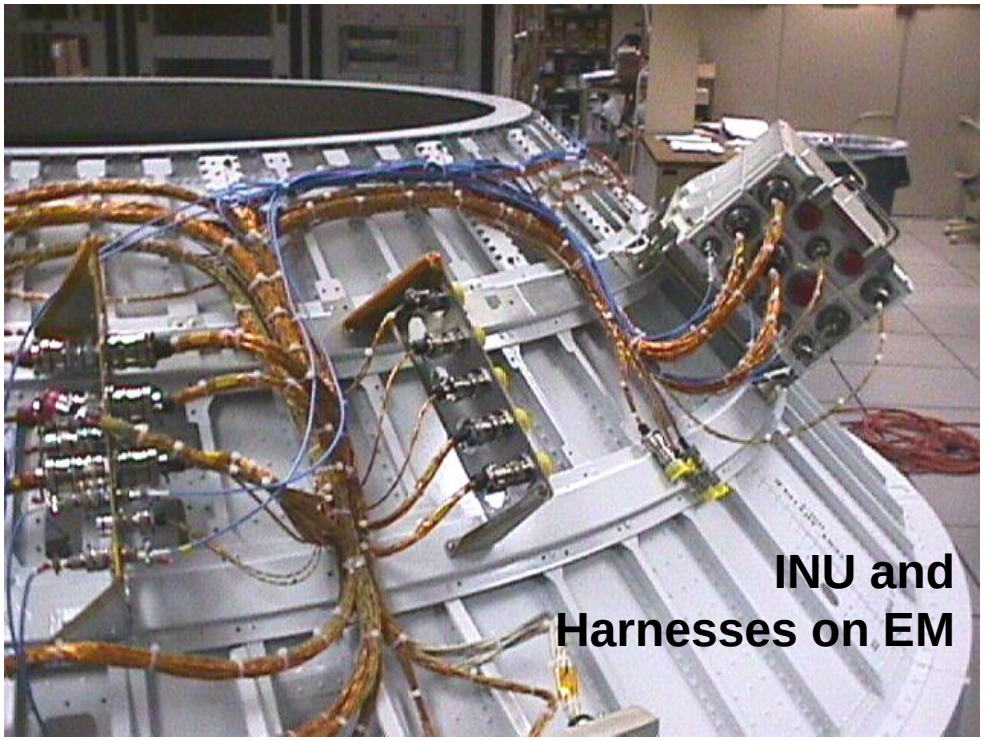
Extended Payload Fairing (EPF)

C-ISA Shipping Dolly

C-ISA (Short)

Heritage Long Payload Fairing (LPF)

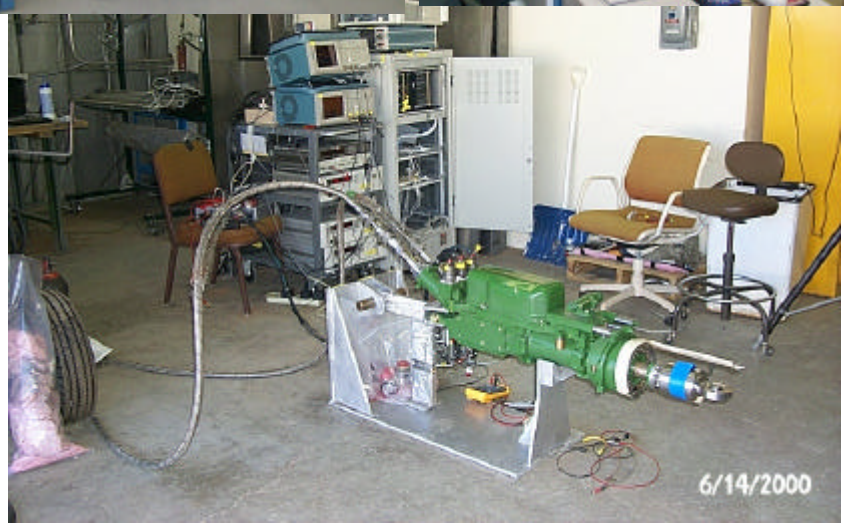
Avionics Qualification Articles



INU and Harnesses on EM

ORCA Test Set

RRGU Test Set



BRCU brass board commanding RD180 actuator

BRCU Test Set

Extended Enterprise

LMA Established Production Facilities

San Diego Operations

Centaur Tanks &
Fluid Components

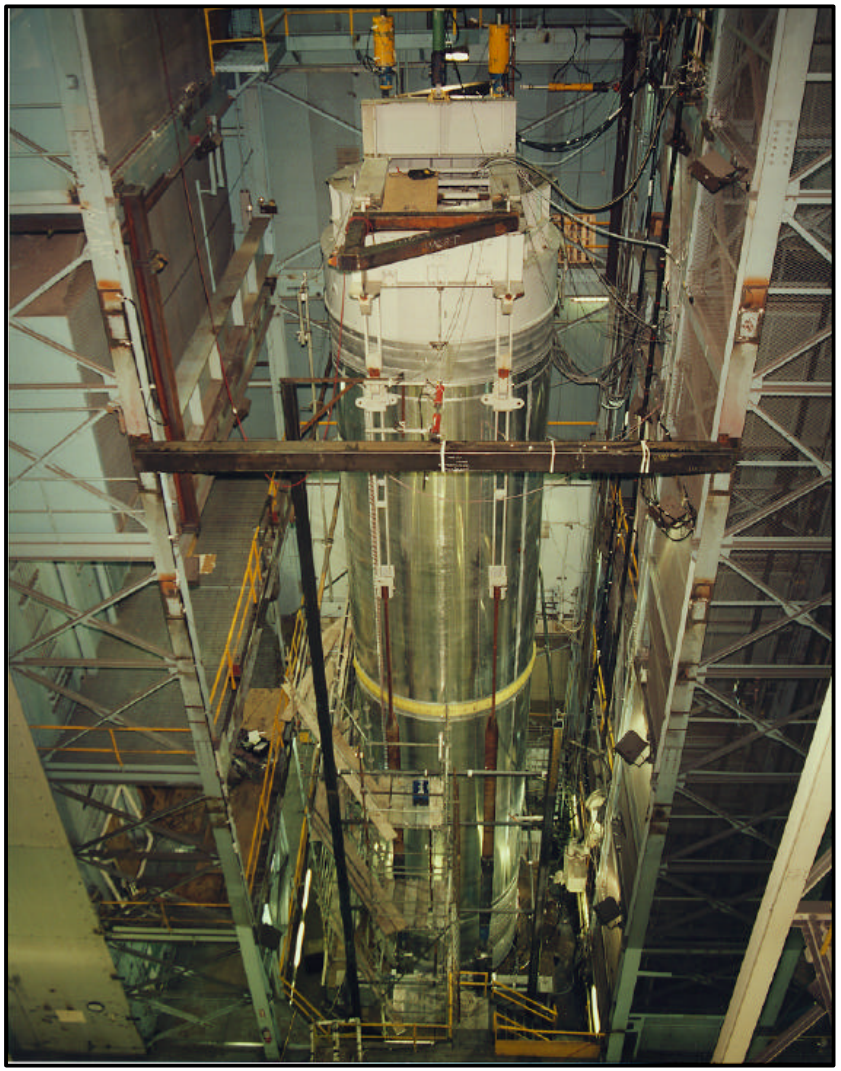
Denver Operations

CCB Propellant Tanks
Final Assembly
Integration and Test

Skirts and Adapters
Aft Transition Structure

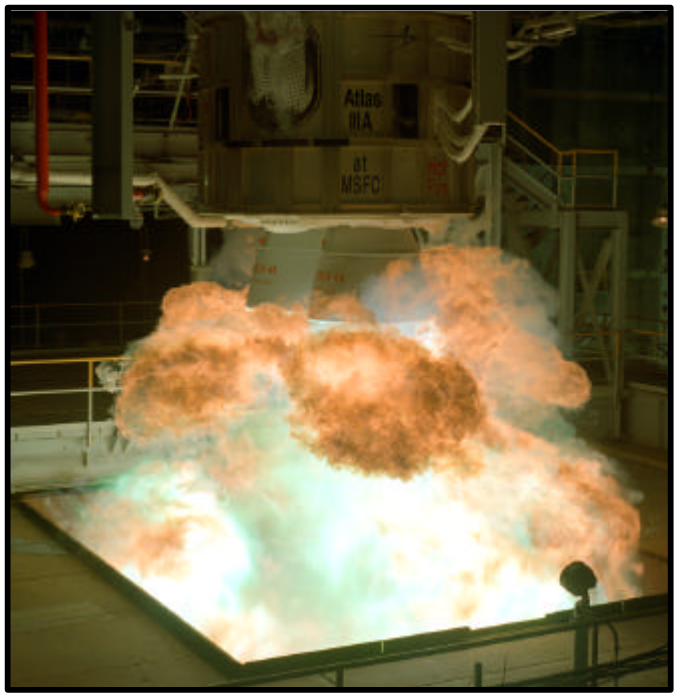
Harlingen Operations

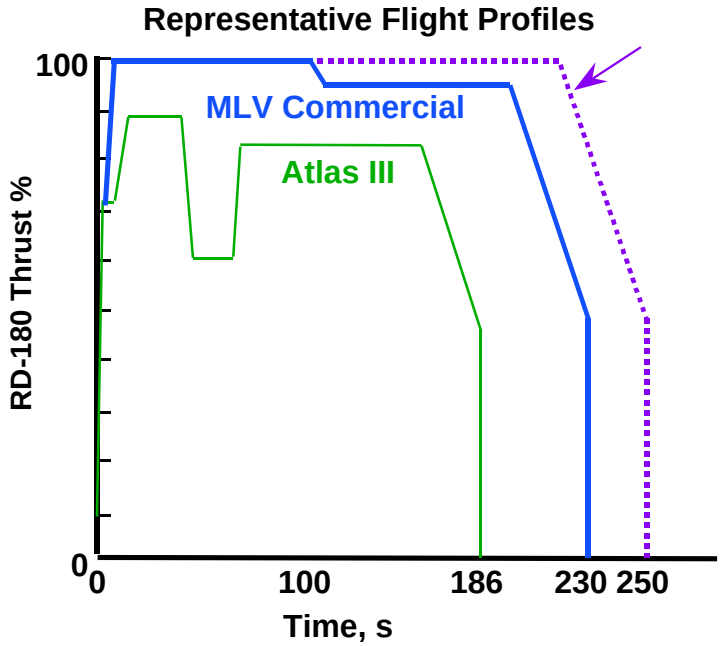
Common Core Booster



LOX Qual Tank Testing
Begun 2Q 2000

RD-180



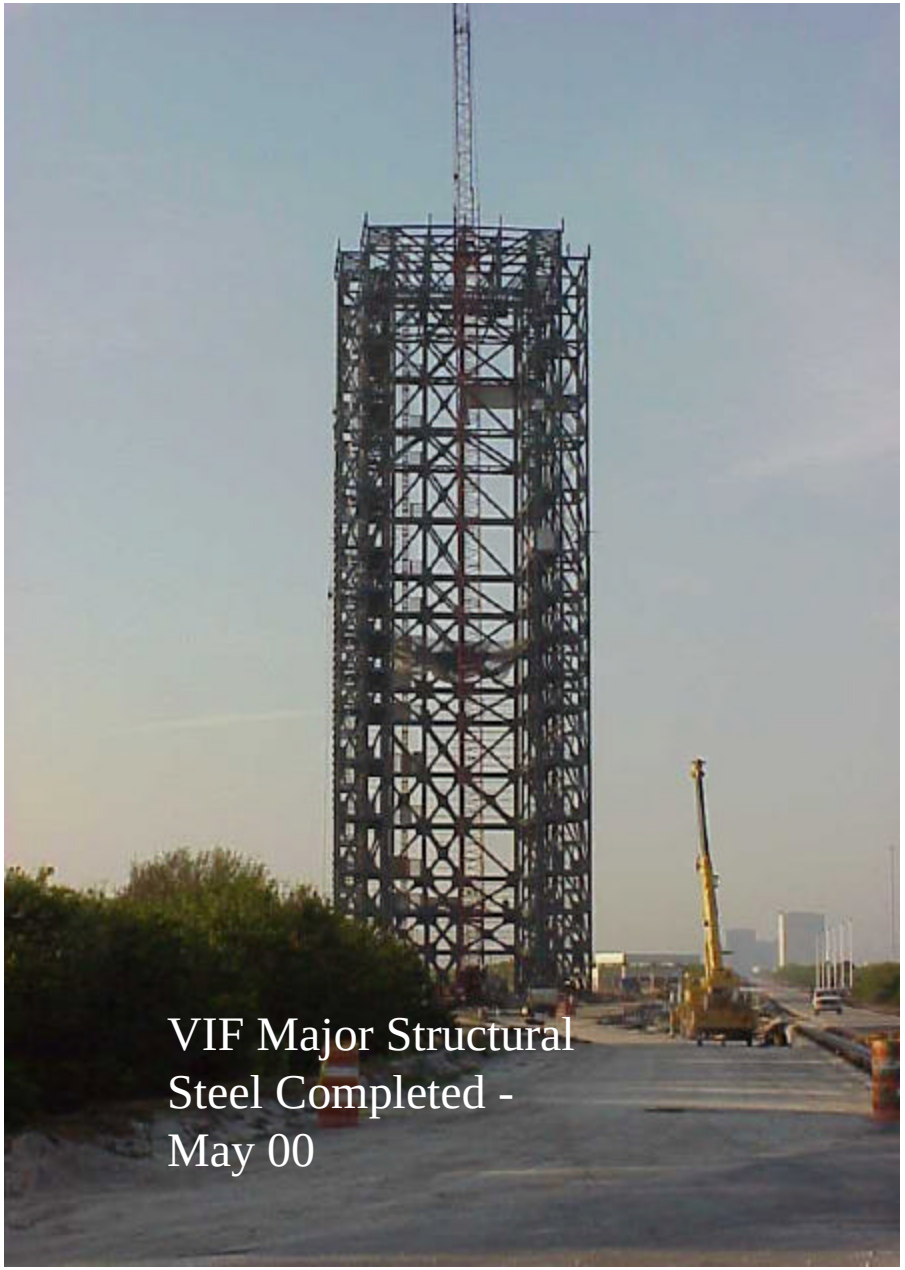


	No. of Tests	Total Test Duration
Total to Date	107	17,722 s
Number of tests at III Certification	86	13,902 s

Atlas III / RD-180 Flight Results

- **RD-180 is now Flight Proven**
  - Throttle Settings of 47% to 92.4% Utilized
    - Atlas V Averages 96%
  - 182 seconds of Engine Run Time During AC-201 Mission
  - All Active Commands and Functions for Flight Exercised: Health Check before release, Mixture Ratio and Thrust Control Valves, Thrust Vector Control Actuators, Solenoids.
- **RD-180 Performed Flawlessly**
  - Engine Throttle Profile Executed as Commanded (Throttle up after Pad Clear, Max Q Throttle, pre-BECO throttle down)
  - Engine Temperature, Pressures, RPMs were all as Predicted

LC-41 Construction



LC-41 Construction

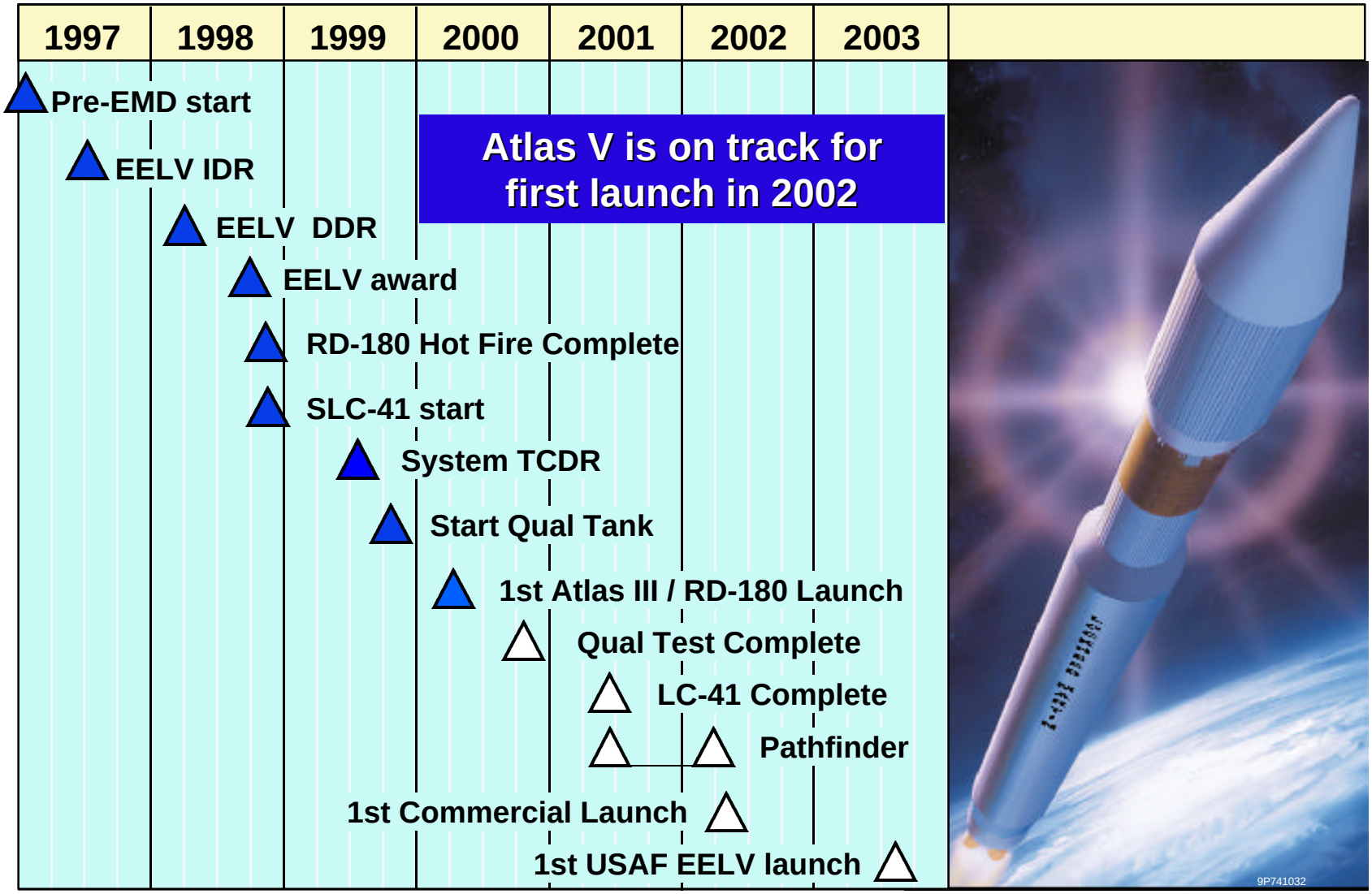
LO2 tank with inner stainless cap in front

Footings for RP1 tank

Mobile Launch Platform Base

Atlas V

Development Schedule



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- **Program Status**
  - Delta IV
  - Atlas V
- **➔Restructure Summary**

EELV Market Analysis Summary

1994 LNCH MOD PLN	1997 - 1998	JAT (Jan 00)	Today
Future med/heavy launch market dominated by government	Launch market dominated by commercial market; DoD 15-20% of market	Launch market dominated by commercial market; DoD 25-30% of market	Launch market dominated by commercial market; DoD 25-30% of market
Little potential in com'l market for growth or economy	Tremendous growth potential in commercial market	Strong GEO market cont. LEO market near-term decline; future uncertain	Strong GEO market cont. LEO market near-term decline; future uncertain
Declining launch demand due to defense reduction	Modest growth in defense launch demand	Modest growth in defense launch demand; slipping out	Modest growth in defense launch demand; slipping out
Multiple ELV families	Multiple ELV families	Multiple EELV families	Multiple EELV families
Conclusion: too many launch providers/production capacity	Conclusion: sufficient market to support two EELV concepts	Conclusion: market may support 2 EELV providers; world-wide supply exceeds demand; high com'l capture req'd	Conclusion: market may support 2 EELV providers; world-wide supply exceeds demand; high com'l capture req'd
Recommendation: reduce industrial overhead; downsize; reduce niche markets	Recommendation: Share development costs between Gov't and commercial	Recommendation: Refine current EELV strategy; evaluate ktr-recommended adjust	Recommendation: one provider at VAFB for all classes, two providers at Cape for all classes
Led to single EELV contractor developing a modular family of vehicles		Stiff competition will require good prices and maximum launch reliability	"Most Favored Customer" will ensure price competition on west coast

Program Office Observations

- Overall Launch Services Market has Declined ~ 7 to 10%
- Production cycle times have been reduced from 48 months to less than 12
- Satellite providers waiting longer to assign payloads to launch slots--balancing risk exposure versus revenue potential
- 1st to Market with a reliable system will determine market share

EELV Restructure Objectives

- Meet all operational requirements
- Minimize impact to heritage systems
- Maintain viable competition
- Balance equities
- Address Launch BAR and JAT recommendations

Lockheed Martin

- No West Coast Pad
- Completion of HLV
- Transfer of DMSP 17 & 18 to Boeing (west coast launches)
- Other Consideration

Boeing

- Complete HLV West Coast Pad
- Fly DMSP 17 & 18 missions
- Contingent for all LMA missions
- Operational Heavy Lift Demo
- Other Consideration

ORD Implications
(Capabilities Required)

- **Para 4: EELV shall meet the threshold for key performance parameters while striving to meet the thresholds and objectives for all other requirements**
- **Key Performance Parameters**
  - Mass to Orbit
  - Reliability
    - Design
    - Mission
  - Standardization
    - Launch Pads
    - Payload Interface

ORD Implications
(Mass to Orbit)

- **Para 4.1.1 Reference Orbits**
  - LEO 17,000
  - POLAR 1 4,400-7,000*
  - ~~POLAR 2 41,000~~
  - SEMI-SYNC 4,500-4,725
  - GTO 6,100-8,500
  - MOLNIYA 7,000
  - GEO 13,500

  * Mission could be flown out of CCAS, range permitting

ORD Implications
(Reliability)

- **Para 4.1.2 Vehicle Design Reliability**
  - Each EELV vehicle shall have a design reliability of at least 98%
  - **NO CHANGE**
- **Para 4.1.3 Mission Reliability**
  - Spacelift system have a mission reliability of at least 97% for heavy missions and 97.5% for remaining missions
  - **NO CHANGE**

ORD Implications
(Standardization)

- **Para 4.1.4.1 Launch Pads**
  - Launch pads that are required to support the EELV portion of the NMM shall be able to launch all configurations of EELV intended to be launched from that site
  - **NO CHANGE**
- **Para 4.1.6 Payload Interfaces**
  - The EELV shall have a standard payload interface (both vehicle and ground) for each vehicle class in the EELV family
  - **NO CHANGE**

Summary

- **All objectives met:**
  - No change to operational requirements
  - No impact to heritage systems
  - Competition maintained across greater than 90% of National Launch Forecast
  - Equities balanced via mission realignment and consideration